Docket No. 9818-CE-100

Response-Data Request-PSC-Grant-Ex.-1

PUBLIC

J1629 Facilities Study FINAL Report – Phase 2

Prepared for the Midcontinent ISO

Rev. 1

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PUBLIC

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Table of Contents

1. Executive Summary

In accordance with the General Interconnection Facilities Study Proposal submitted to Midcontinent Independent System Operator (Midcontinent ISO) by American Transmission Company LLC (ATC), ATC has provided the estimate for the performance of an Interconnection Facilities, Facilities Study (IFFS) for the Generation Interconnection Request designated as J1629. The MISO DPP 2020 Cycle 1 Phase 1 East (ATC) System Impact Study (SIS) Report, dated July 8, 2021 is the basis for this IFFS report.

The J1629 project consists of constructing a new Interconnection Switching Station, J1629 SS, on ATC's (Transmission Owner's) 345 kV W-5 line between Columbia Substation and South Fond du Lac Substation, providing interconnection to the Generation Owner's (Interconnection Customer) proposed Generator Collector Station located in Columbia County, Wisconsin. The existing 345 kV W-5 Columbia – South Fond du Lac Line will be re-routed through the new Switching Station to accommodate the Generation Owner's new interconnection. The portion of lines between Columbia and the new J1629 SS will be renumbered W-TBD. The portion of the line between South Fond du Lac Substation and the new J1629 SS will remain W-5. Remote end work is required at Columbia and South Fond du Lac Substations. Underground Fiber will be routed from the existing 69 kV Y-64 Line into the J1629 SS to incorporate the new substation into the ICON ring.

Changes from revision 0 to revision 1 of this report include moving the gen-tie line connection from entering the interconnect station from the north to the west. As a result the interconnection substation dimensions changed. Exhibit A3 was revised to reflect this new layout and interconnection pad dimensions. Exhibit A12 (Construction and Coordination schedule) was updated based on MISO DPP-2020-Cycle 1 Schedule dated February 1, 2022. Construction is now shown to start in 2025. Based on the new construction date escalation of estimates in exhibits A5, A6 and A9 were updated to show 2025 dollars (from 2024).

The total estimated cost of facilities to be constructed by the transmission owner can be found in Exhibit A5.

1.1 Report Assumptions

This report is based on the following assumptions and clarifications.

- The Point of Interconnection (POI) will be where the conductors associated with the Generator Lead Line from the Interconnection Customer are connected to the rigid bus for the Transmission Owner's Interconnection Switching Station.
- The Point of Change of Ownership (PCO) will be the Generator Lead Line conductor and the shield wire attachment vangs on the dead-end structures in the Transmission Owner's Interconnection Switching Station. The Transmission Owner will own up to and including the dead-end structures in the Interconnection Switching Station.
- The Interconnection Switching Station will be built on property secured by the Interconnection Customer. The scope of work and estimates have been developed based on the assumption that the Interconnection Customer shall obtain all right-of-way, land, or any other real estate, easements, and access associated with the Generator Collector

Station, Interconnection Facilities, Generator Lead Line work, and access road and bear all costs associated with these items.

- The Interconnection Customer will grant Transmission Owner perpetual and exclusive easements required to build, operate, maintain and access the Transmission Owner's facilities at and to the Interconnection Switching Station. If property is purchased by the Interconnection Customer, it shall be abutted/adjacent to Transmission Owner's existing transmission line. The Transmission Owner is to maintain existing right of way and easement rights.
- The Interconnection Customer is responsible to design, furnish, permit and install all storm water management facilities associated with the Interconnection Facility including the Transmission Owner's facilities.
- The Transmission Owner will obtain the necessary permits and wetland mitigation, if required, for its facilities at remote substations and transmission line assets.
- The Interconnection Customer will furnish a report detailing, as determined by the Transmission Owner, the soil borings for substation foundations and transmission line structures to be performed at the site for Transmission Owner's Interconnection Facilities to determine site suitability and proper foundation designs.
- The Interconnection Customer will furnish, install, own, operate, and maintain the transmission line between the Interconnection Customer's generation facility and the Transmission Owner's Interconnection Facility (Generator Lead Line).
- The Transmission Owner will furnish, install, own, operate, and maintain the relays and associated communication equipment that are located in the Transmission Owner's facility for the Generator Lead Line.
- The Interconnection Customer will furnish, install, own, operate, and maintain the relays and associated communication equipment that are located in the Interconnection Customer's Generator Collector Station for the Generator Lead Line.
- The phasing and phase sequence of the Interconnection Customer's Generator Collector Station will match the Transmission Owner's system and phase swapping is not required at the PCO. If phase swapping is required for any reason, it will be the responsibility of the Interconnection Customer.
- The Interconnection Customer will terminate the Generator Lead Line phase conductor and shield wire on the dead-end structure at the Transmission Owner's Interconnection Switching Station. The phase conductor terminals will be a double tongue compression type with NEMA 4-hole pads. The Transmission Owner will furnish and install the jumpers and fittings and equipment from the phase conductor terminal compression fitting to the Interconnection Switching Station equipment.
- The Interconnection Customer shall size its Interconnection Facilities to appropriately coordinate with the Transmission Owner Interconnection Facilities. The Transmission Owner and the Interconnection Customer shall exchange information before the Commercial Operation Date or implementation of any future modifications, including identification of the most limiting piece of equipment, to achieve common understanding of each party's respective Interconnection Facilities' normal and emergency ratings.
- Road Access Information:
  Specific requirements are determined during the detailed design phase of a project, based on substation site and scope. However, some basic requirements include the following:

  - Minimum width of 24’ with crown.
  - Incorporate a turning radius for 53’ trailer/semis.
  - Capable of supporting heavy equipment traffic – weight rating and surface material/depth to be determined in detailed design.
  - Geotextile fabric may be needed based on subgrade soil conditions.
  - Use dense-graded aggregates for base course material. Achieve 98% compaction per Standard Proctor (ASTM D698).
- All metering takes place at the Generator Collector Station. The Interconnection Customer will be responsible for maintaining and monitoring this equipment. No Balancing Authority (BA) metering will be required within the Transmission Owner’s Interconnection Switching Station. Remote Terminal Units or metering panels for the Local Distribution Company (LDC) will not be required within the Transmission Owner’s Interconnection Switching Station.
- A length of 200 feet is assumed between the Interconnect Customer high side breaker control cabinet and the West fence line of the Transmission Owner Interconnection Switching Station. Two (2) 4/C #6 cables and one (1) 12/C #8 cables will be provided between the Interconnect Customer high side breaker CTs and the bus differential panel in the J1629 control building. The network upgrades estimate includes the cost for the cables, conduit, excavation and backfill to install those cables.
- The Interconnection Customer will provide the Transmission Owner with a rough graded pad adequate for the Transmission Owner’s Interconnection Switching Station. The rough graded pad shall be well compacted (>95%) for the full depth of the fill with a pad slope of no more than 1% to 1.5% across the entire site of the Transmission Owner’s Interconnection Switching Station. Interconnection Customer will remove any overburden/unsuitable material down to competent material across the entire Interconnection Switching Station pad, and suitable fill will be added to get back to rough grade. Rough grade elevation should meet or exceed surrounding grade. Interconnection Customer to comply with Transmission Owner’s construction specification for fill. It is assumed all fill materials are adequate for drilled pier foundation construction without the need for casing the foundation holes. The costs associated with all site development and rough grade work as described above is not included in this Facilities Study and it will be paid for by the Interconnection Customer.
- The specific site and property for constructing the Transmission Owner’s Interconnection Switching Station and access road has not been completely determined. This Facilities Study report assumes that, generally, the site will be located North of the existing Line W-5 between structures 111 and 112 less than 300ft off W-5 line centerline.
- Interconnection Customer’s Generator Lead Line general approach is assumed to be from the West of the Transmission Owner’s Interconnection Switching Station as shown on Exhibit A3-1.
- The design called out in this facility study has no interferences with local distribution company underground circuits.
- The Generator Lead Line approaches the Interconnection Switching Station from the West and there are no conflicts with existing ATC lines. This study assumes any Generator Lead Line crossings of ATC transmission lines will be handled via the encroachment process. Any costs associated with the Generator Lead Line crossing a Transmission Owner transmission lines are not included in this report.

- Fiber will be routed from the ATC Fiber ICON ring to the J1629 Switching Station via underground fiber from the existing 69kV Line Y-64 located 16,100 ft North of the proposed J1629 Switching Station. The underground fiber will terminate within the J1629 substation in an underground cable vaults located within 250 feet of the new J1629 control house.
- All scope associated with updating relay settings at both remote end facilities, Columbia Substation and South Fond du Lac Substations, will be identified in the Non-Stand-Alone Network Upgrades. The costs associated with the relay updates will be included in the J1629 Switching Station Network Upgrades estimate.
- This report documents the Interconnection Facilities between the Transmission Owner's interconnection facility and the Interconnection Customer's generation facilities.
- The Transmission Owner Interconnection Facility includes the equipment between the POI and PCO, including dead-end, foundations, surge arresters, and disconnect switch.
- Interconnection Customer Interconnection Facilities are not detailed in this report. This report does define Interconnection Facilities in enough detail to explain basic requirements.
- Additional clarifications and assumptions are indicated throughout this Facilities Study report and its associated Exhibits.

2. Transmission Owner Interconnection Facilities (TOIF)

2.1 J1629 Switching Station (TOIF)

2.1.1 Overview:

The J1629 TOIF will consist of jumpers and equipment to connect the Interconnection Customer's Generator Lead Line equipment with the Transmission Owner's rigid bus. A line disconnect switch will isolate the Generator Lead Line from the three-position ring bus interconnection substation facility. Insulators on the substation dead-end will route conductors to the motor-operated line disconnect switch and surge arresters, followed by a flexible connection to substation rigid bus. Any shielding wire for the Interconnection Customer facilities will terminate at the Interconnection Switching Station dead-end vangs. The Transmission Owner will retain ownership of the dead-end, jumpers, switch, surge arresters, and OPGW splice boxes. The TOIF scope will include one (1) 345 kV dead-end, (1) 345 kV high disconnect switch stand, and (3) 345 kV low surge arrester stands. All new substation equipment will target a minimum continuous SN rating of 3000 Amps.

2.1.2 Design Assumptions and Notes:

Assumptions
See Section 1.1.

Design Criteria
Latest revision of ATC Substation Design Guide and/or Criteria, GD-1030/CR-0060, will be used. If no ATC standards apply, then applicable local distribution company (LDC) standards or industry standards will be used.

Insulation Coordination
New equipment installed in the 345 kV Switching Station will be per the following:

Nominal Operating Voltage (phase-to-phase)	345 kV
Nominal Phase-to-Phase Voltage	345 kV
Nominal Phase-to-Ground Voltage	200 kV
Maximum Phase-to-Phase Voltage	362 kV
Maximum Phase-to-Ground Voltage	209 kV
Basic Insulation Level (BIL)	1300 kV

Design Constraints:

a. Environmental: The Interconnection Customer is responsible for obtaining the necessary permits and wetland mitigation, if required, for J1629 Switching Station. The Interconnection Customer is responsible for designing and constructing stormwater facilities associated with J1629 Switching Station.

b. Real Estate: J1629 Switching Station will be constructed on property owned by the Interconnection Customer.

c. Operability/Maintainability: Transmission Owner will be solely responsible for the operation and maintenance of all new equipment in the Transmission Owner Interconnection Station. The new 345 kV motor-operated line disconnect switch needs to be capable of being operated locally in the new Transmission Owner control building and remotely from the SOC.

d. Construction: Transmission Owner will be responsible for construction, testing, and commissioning of all new equipment in the Transmission Owner Interconnection Station.

e. FAA: As required, new structures will be evaluated for FAA and WDOT compliance by the Transmission Owner. Marking and lighting requirements will be identified by permitting.

f. Others: N/A

2.1.3 Protection and Control:
N/A

2.1.4 SCADA and Communications:
N/A

2.1.5 Structures and Foundations:
ATC Substation Structural Design Criteria, CR-0501, will be used.

ATC standard steel structures will be used.

Geotechnical test report will be used for foundation designs. Standard foundation designs indicated below will be modified accordingly based on soil conditions.

Steel Structures

QTY	VOLTAGE	TYPE
1	345 kV	High Disconnect Switch Stand
3	345 kV	1Φ Low Surge Arrester Stand
1	345 kV	H-Frame Dead-End Structure

Foundations

QTY	TYPE	FUNCTION
2	Drilled-Pier	345 kV High Disconnect Switch Stand
3	Drilled-Pier	345 kV 1Φ Low Surge Arrester Stand
2	Drilled-Pier	345 kV H-Frame Dead-End Structure

2.1.6 Major Equipment:

Disconnect Switch (3-phase)

QTY	VOLTAGE	STYLE	MOUNTING	MOTOR OPERATOR REQUIRED	LOAD BREAKING	MAXIMUM CONTINUOUS CURRENT
1	345 kV	Double End Break	Horizontal	Yes	No	3000 amp

Surge Arrester

QTY	VOLTAGE	MCOV	TYPE
3	345 kV	212 kV	Polymer

Relaying, Control and SCADA
N/A

Control Building
N/A

2.1.7 Other Substation Scope:

Physical Overview:
J1629 TOIF consists of installing one (1) H-Frame dead-end structure, one (1) motor operated line disconnect switch underneath the H-frame, and three (3) surge arresters. The line disconnect switch will be jumpered to the incoming Generator Lead Line and ring bus. The surge arrestors will be mounted on separate structures with a one-way jumper tapping off the jumpers between the line disconnect and the Generator Lead Line.

Site Work:
The Interconnection Customer and Transmission Owner will coordinate site work for initial and final grading. The Interconnection Customer will perform all site clearing, grubbing, and rough grade work for the Interconnection Switching Station. The Interconnection Customer will provide the site access road and provide rough graded pad for the Transmission Owner's Interconnection Switching Station site. As necessitated by the local regulatory agencies, the Interconnection Customer will design, permit, furnish, and install a storm water drainage collection system to accommodate the Interconnection Switching Station. The Transmission Owner will install 8-12" crushed rock surfacing of the Substation pad for final grading.

The Interconnection Customer shall furnish a geotechnical report and soil borings for foundation design.

Security:
N/A

Oil Spill Containment System:
N/A

Balancing Authority Metering:
ATC business practice "Coordination of Local Balancing Authority Metering Boundary Modifications" will be used.

Auxiliary Station Power and AC/DC System:
N/A

Grounding System:
ATC Substation Grounding System Guide, GD-1000, will be used or specify LDC grounding requirements that apply.

The new equipment shall be connected to the new ground grid per Transmission Owner Standards.

Lightning Shielding Design:
N/A

Yard Lighting:
N/A

Other Material

- 1590 kcmil AAC (2/c - 1Φ) for load carrying conductors
- 2500 kcmil AAC(1/c - 1Φ) for non-load carrying conductors
- Compression lugs and fittings
- H-frame Insulators: High Strength – TR368 (345 kV)

Removal:
N/A

3. Stand Alone Network Upgrades

3.1 J1629 Switching Station (Network Upgrades)

3.1.1 Overview:

The new J1629 Interconnection Switching Station will be arranged in a three-breaker ring bus configuration with one generation position and two-line positions. The station will be capable of future expansion to an ultimate 6 position ring bus if future generation positions are added. The new J1629 interconnection switching station will bisect the Transmission Owner's overhead W-5 345 kV transmission line between existing Columbia and South Fond du Lac substations in two segments, W-TBD and W-5. All new substation equipment will target a minimum continuous SN rating of 3000 Amps.

Relay protection and controls will consist of two-line relay panels with primary and secondary schemes (W-TBD, W-5), one line protection panel utilizing a differential protection scheme (J1629 Interconnection Line), and two panels consisting of breaker failure and auto reclose relay protection for the three J1629 Switching Station breakers. The panels will be installed in a new 24' by 36' control house.

The Transmission Owner will maintain ownership of all W-TBD and W-5 related work and the J1629 Switching Station up to the Point of Change of Ownership (PCO).

3.1.2 Design Assumptions and Notes:

Assumptions
See Section 1.1.

Design Criteria
Latest revision of ATC Substation Design Guide and/or Criteria, GD-1030/CR-0060, will be used. If no ATC standards apply, then applicable local distribution company (LDC) standards or industry standards will be used.

Insulation Coordination
New equipment installed in the 345 kV Switching Station will be per the following:

Nominal Operating Voltage (phase-to-phase)	345 kV
Nominal Phase-to-Phase Voltage	345 kV
Nominal Phase-to-Ground Voltage	200 kV
Maximum Phase-to-Phase Voltage	362 kV
Maximum Phase-to-Ground Voltage	209 kV
Basic Insulation Level (BIL)	1300 kV

Bus Fault Levels (Maximum)
Maximum generation fault current contributions to the Transmission Owner's network are defined in the MISO DPP 2020 Cycle East (ATC) Area Study Phase 2 Report. This facilities study accounts for the network upgrade costs to mitigate the total system fault current at the POI.

Design Constraints:

a. Environmental: The Interconnection Customer is responsible for obtaining the necessary permits and wetland mitigation, if required, for J1629 Switching Station. The Interconnection Customer is responsible for designing and constructing stormwater facilities associated with J1629 Switching Station.

b. Real Estate: J1629 Switching Station will be constructed on property owned by the Interconnection Customer.

c. Operability/Maintainability: Transmission Owner will be solely responsible for the operation and maintenance of all new equipment in the Transmission Owner Interconnection Station. The new 345kV motor-operated disconnect switches need to be capable of being operated locally in the control building and remotely at the SOC.

d. Construction: Transmission Owner will be responsible for construction, testing, and commissioning of all new equipment in the Transmission Owner Interconnection Station.

e. FAA: As required, new structures will be evaluated for FAA and WDOT compliance by the Transmission Owner. Marking and lighting requirements will be identified by permitting.

f. Others: N/A

3.1.3 Protection and Control:

Protection and control systems for the new J1629 Switching Station are shown in Exhibit A2-1 and are summarized as follows:

<u>345kV Protection & Control</u>

- (2) Standard Two Breaker Line Protection Panel – SEL-411L CD/DDT and SEL-311C DCU schemes.
- (1) Standard Bus Differential Panel – SEL-587Z/487B schemes.
- (1) Standard SEL-351A PMU relay.
- (2) Standard Two Breaker Control Panel – SEL-451 Breaker Control Scheme.

3.1.4 SCADA and Communications:

A standard RTU panel will be used.

A free-standing communication cabinet with a router and switch will be used. Hardwired points for control and indication will be provided by SMP-I/O modules located in the relay panels that will communicate with the router via Ethernet. Microprocessor relays capable of Ethernet communication will be connected to the switch as well.

The new Generator Lead Line will be protected by one (1) bus differential panel with a SEL-587Z/487B relay scheme and a SEL-351A PMU relay and utilitze one (1) dual breaker control panel with SEL-451 BF/ auto reclose with one (1) SEL-451 relay installed for the line

connection. The 487B relay circuit and control cables for the Interconnection Customer's high side breaker and the Transmission Owner line breaker will terminate in the ATC control house. The 587Z relay circuit cables for the Interconnection Customer's high side breaker and the Transmission Owner line breaker will terminate at a summation box attached to the Generator Lead Line dead-end structure. Additional relay cables will be provided between the summation box and the bus differential panel within the ATC control house

Underground fiber connected to the ICON network from Line Y-64 will be routed into the J1629 Switching Station from the North into two fiber vaults located near the West fence line. From the fiber vaults, all fiber cable routes will utilize underground conduit and the switching station trench system to run to the fiber optic patch panel located in the Transmission Owner's communication cabinet within the new control house.

The J1629 Switching Station Stand Alone Network Upgrade includes costs for the fiber optic vaults, markers, tracer wire and conduit within the Transmission Owner's Interconnection Station only. The fiber optic cable for the ICON network connection will be included in the underground fiber estimate.

3.1.5 Structures and Foundations:

ATC Substation Structural Design Criteria, CR-0501, will be used.

ATC standard steel structures will be used.

Geotechnical test report will be used for foundation designs. Standard foundation designs indicated below will be modified accordingly based on soil conditions.

Steel Structures

QTY	VOLTAGE	TYPE
2	345 kV	H-Frame Dead-End Structure
3	N/A	90' Lightning Shield Mast
6	345 kV	High Disconnect Switch Stand
8	345 kV	Low Disconnect Switch Stand
2	345 kV	3Φ High Bus Support
2	345 kV	3Φ Low Bus Support
12	345 kV	1Φ Low Bus Support
6	345 kV	1Φ Low Surge Arrester Stand
11	345 kV	1Φ Low CCVT Stand
1	345 kV	Low SSVT Stand
6	N/A	Security Camera Mast
3	345 kV	Gas Circuit Breaker Platform and Steps

Foundations

QTY	TYPE	FUNCTION
1	Wall and Pier	Control Building (24' x 36')
3	Slab	345 kV Gas Circuit Breaker (9' x 32')
1	Slab	Pad Mount Aux Power Transformer
4	Drilled-Pier	345 kV H-Frame Dead-End Structure
3	Drilled-Pier	90' Lightning Shield Mast
12	Drilled-Pier	345 kV High Disconnect Switch Stand
16	Drilled Pier	345 kV Low Disconnect Switch Stand
4	Drilled-Pier	345kV 3Φ High Bus Support
4	Drilled-Pier	345kV 3Φ Low Bus Support
12	Drilled-Pier	345 kV 1Φ Low Bus Support
6	Drilled-Pier	345 kV 1Φ Low Surge Arrester Stand
11	Drilled-Pier	345 kV 1Φ Low CCVT Stand
1	Drilled-Pier	345 kV SSVT Stand
6	Drilled-Pier	Security Camera Mast

3.1.6 Major Equipment:

Gas Circuit Breaker

QTY	VOLTAGE	CYCLES	SHORT CIRCUIT	CURRENT
3	345 kV	2	50 kA	3000 amp

Disconnect Switch (3-phase)

QTY	VOLTAGE	STYLE	MOUNTING	MOTOR OPERATOR REQUIRED	LOAD BREAKING	MAXIMUM CONTINUOUS CURRENT
2	345 kV	Double End Break	Horizontal	Yes	No	3000 amp
8	345 kV	Double End Break	Horizontal	No	No	3000 amp

Line Trap

QTY	VOLTAGE	CURRENT	MOUNTING
2	345 kV	3000 amp	CCVT Vertical

Line Tuner

QTY	TYPE
2	Single Frequency

Voltage Transformer / Aux.Power Transformer

QTY	VOLTAGE	TYPE	RATING
1	345 kV	SSVT (1-Φ)	100 kVA
1	TBD	Pad Mount Aux Power Transformer	100 kVA
11	345 kV	Voltage Transformer (CCVT/PT)	NA

Surge Arrester

QTY	VOLTAGE	MCOV	TYPE
6	345 kV	212 kV	Polymer

Relaying, Control and SCADA

Relay, SCADA and Control Panels

QTY	VOLTAGE	FUNCTION
3	345 kV	Line Protection Panel
1	345kV	Bus Differential Panel
2	345 kV	Two Breaker Control Panel
1	N/A	SEL-351 PMU
1	N/A	RTU Cabinet
1	N/A	Communication Cabinet
1	N/A	Security Cabinet
2	N/A	90" Main Termination Cabinet (MTC)

Control Building

Control Building Specifications

Scope of Work	New Building
Size	24 x 36
Special Requirements	Hardened (Level 8)

Battery

QTY	VOLTAGE	# CELLS	CAPACITY	RACK
2	125 Vdc	60	200 ah	2-step

Battery Charger

QTY	VOLTAGE	CAPACITY
2	125 Vdc	25 amp

AC/DC Panel

QTY	VOLTAGE	CAPACITY
1	240/120 Vac	400 amp
2	125 Vdc	225 amp

AC Transfer Switch

QTY	VOLTAGE	CAPACITY
1	240 Vac	400 amp

3.1.7 Other Substation Scope:

Physical Overview:
The J1629 Switching Station will be built as three-position ring bus, and will consist of installing three (3) 345 kV gas circuit breakers, eight (8) bus disconnect switches, two (2) motor-operated line disconnect switches, eleven (11) CCVTs, two (2) line traps with tuners, one (1) 1- Φ SSVT, six (6) surge arresters, two (2) H-Frame dead-end structures, and three (3) 90' lightning shield masts. Bus-work and jumpers will be required to connect major equipment in the yard. A new 24' x 36' control house will be constructed. Control cable will be run from the yard equipment to the control house via conduit and cable trench.

Site Work:
The Interconnection Customer and Transmission Owner will coordinate site work for initial and final grading. The Interconnection Customer will perform all site clearing, grubbing, and rough grade work for the Interconnection Switching Station. The Interconnection Customer will provide the site access road and provide rough graded pad for the Transmission Owner's Interconnection Switching Station site. As necessitated by the local regulatory agencies, the Interconnection Customer will design, permit, furnish, and install a storm water drainage collection system to accommodate the Interconnection Switching Station. The Transmission Owner will install 8-12" crushed rock surfacing of the Switching Station pad for final grading.

The Interconnection Customer shall furnish a geotechnical report and soil borings for foundation design.

Security:
A metal fence will be installed along the J1629 Switching Station perimeter. A security cabinet will be installed in the control house along with security cameras and lighting throughout the substation
yard.

Oil Spill Containment System:
N/A

Balancing Authority Metering:
ATC business practice "Coordination of Local Balancing Authority Metering Boundary Modifications" will be used.

Auxiliary Station Power and AC/DC System:
ATC Substation AC Aux System, GD-7100, and/or Substation DC Aux System, GD-7210, will be used.

Station Service AC Supply System:
AC station service will be provided by two sources.

- The primary source will be a stand-mounted station service voltage transformer (SSVT) tapped from a single phase of the switchyard rigid bus.
- The backup source will be a pad mounted SSVT located near the control building and is fed from an external local distribution company.
- Both SSVTs will route to a 400 A secondary disconnect switch installed on the exterior wall of the control building.
- Both SSVTs will be 100 kVA units. The automatic transfer switch will be a 400 A unit.

Station Service DC Supply System:
Two (2) 200 Ah battery banks and two (2) 25 A battery chargers are recommended. This is subject to change pending detailed design.

Grounding System:
ATC Substation Grounding System Guide, GD-1000, will be used or specify LDC grounding requirements that apply. The new equipment shall be connected to the new ground grid per Transmission Owner Standards. The ground grid will be designed for the anticipated phase-to-ground fault current. A grounding study will be performed using the soil resistivity values provided by the Interconnection Customer. An as-built grid resistance test will be performed after construction.

A shared ground grid will be utilized between the Collector Station and the Interconnection Switching Station due to the close proximity to one another.

Lightning Shielding Design:
ATC Direct Lightning Stroke Shielding of Substations, GD-0891, will be used. The lightning shielding system will be designed and installed per Transmission Owner standards. In addition to the static protection vangs attached to the new 345kV H-frame dead ends, it is assumed three (3) 90’ shield mast will be required to protect the entire yard.

Yard Lighting:
ATC Substation Lighting Design Guide, GD-7400, will be used. Substation yard lighting will be designed and installed per ATC’s standards and will be sufficient to facilitate emergency egress from the substation and to visually determine disconnect switch position.

Other Material

- Rigid Bus, Insulators, and Fittings
    - Rigid bus will be 5” schedule 40 aluminum tube
    - Bus A-frames will be 3.5” schedule 40 aluminum tube
    - 795 kcmil ACSR conductor will be used for bus damping
    - All rigid bus fittings will be compression type.

  - Insulators: High Strength – TR368 (345 kV)
- Conductors and Fittings
  - 1590 kcmil AAC (2/c - 1Φ) for load carrying conductors
  - 2500 kcmil AAC(1/c - 1Φ) for non-load carrying conductors
- Grounding
  - Ground grid conductor will be 4/0 soft drawn bare copper conductor installed a minimum of 18" below the subgrade surface. The ground grid will extend outside the new substation fence by 3'.
  - Ground rods and ground tails will be installed.
  - Above grade ground conductor connections will be compression or bolted type. Below grade ground conductor connections will be exothermic weld type.
- Fence and Gates:
  - 9 Gauge ¾" Expanded Metal Mesh (10' high) fence
  - 20' Wide Gates – Expanded Metal Mesh with Drop Post
- Control Cable
  - Control cable will be installed per Transmission Owner standards in direct buried PVC conduit and pre-cast cable trench.
- Cable trench with removable lids
- Fiber optic cable
- Substation shield conductor will be 7/16" EHS galvanized steel.
- Junction boxes for CCVTs, Lighting Circuits, and Security Cameras
- LED Instant On floodlights

Removal:
N/A

3.2 Underground Fiber (69kV Y-64 Line to J1629 Switching Station)

The existing relay protection for the 345kV line W-5 is presently using fiber through a ICON network as a relay communication path. Sectionalizing the line requires the ICON fiber network to be brought into the new substation to maintain this configuration. The existing ICON fiber network does not run along W-5. The ICON fiber network is on the Y-64 line which is north of the proposed J1629 Switching Station. The fiber ICON ring segment between South Fond du Lac Substation and Columbia Substation includes OPGW over Y-64 from structure 100076 at Y-64 ACEC Cambria Tap to the Rio Pumping Station. The existing fiber network will be tapped at splice box on structure 100075. From there the fiber will be routed to J1629 Switching Station by underground fiber buried along road ROW. Total fiber route is approximately 3 miles.

See exhibits for applicable drawings and layouts.

4. Non-Stand-Alone Network Upgrades

4.1 Columbia Substation

No equipment upgrades required. The existing 345 kV 411L/311C/UPLC-11 Line W-5 protection panel will be re-utilized. Relay settings changes will be required based on the revised line parameters.

4.2 South Fond du Lac Substation

No equipment upgrades required. The existing 345 kV 411L/311C/UPLC-11 Line W-5 protection panel will be re-utilized. Relay setting changes and modifications to the PLC scheme will be required based on the revised line parameters.

4.3 Transmission Line Scope (W-5 345 kV Transmission Line):

Project Location: Spingvale/Courtland Township, Columbia County

4.3.1 Overview:

The W-5 345 kV Transmission Line Loop-In project will consist of installing two new single-circuit 90deg deadend poles between structures 111 and 112, that will allow existing line W-5 to run through the Transmission Owner's new switchyard, segmenting the line into W-5 towards South Fond Du Lac (SFL) and W-TBD towards Columbia (COL). Existing tangent structure 111 will be removed and replaced with one of the 90deg dead-end poles. Insulators on the line dead-end poles and switchyard dead-ends will route the conductors to the bus connections and surge arresters. Existing conductors and shield wire for W-5 will terminate at the new poles along the existing alignment and new wires will be strung between the poles and their associated switchyard dead-end structures. All equipment and hardware on the switchyard side of the line and shield wire terminations are addressed in the Transmission Owner's new Interconnection Switching Station.

The Transmission Owner will retain ownership of the line segments, support poles and Interconnection Facility.

See exhibits for applicable drawings and layouts.

4.3.2 Assumptions & Design Constraints:

Assumptions:

- The existing LiDAR model reflects conditions in the field. Ground elevation for area of proposed J1629 Switching Station was assumed.

- Galloping clearances for the affected spans were not able to be checked accurately due to the presence of detuning pendulums modeled as concentrated loads. Since the affected spans are being shortened or remaining the same relative length, assumed galloping criteria is met.

- Substation location and approximate takeoff structure location as indicated in preliminary site plan provided.

Design Criteria: Design standards shall be the ATC standards (ATC Transmission Line Design Criteria, Document CRT-0030). If no ATC standard exists, then the applicable industry standard will be used. Third-party structure attachments shall be designed in accordance with the appropriate third party standards.

Transmission Line Design Constraints:

a. Environmental: N/A

b. Real Estate: N/A

c. Operability/Maintainability: N/A

d. Construction: N/A

e. FAA: All new structures included in the scope of work will be evaluated during detailed design using FAA Notice Criteria Tool. Any structures that exceed the criteria will be filed with FAA.

f. Others: N/A

4.3.3 Structures & Foundations:

The proposed tap line consists of two (2) 90° dead-end single-circuit structures. One (1) structure will be used to connect the switching station to the existing W-TBD line towards Columbia (COL) substation, and one (1) structure will be used to connect the switching station to the existing W-5 line towards South Fond Du Lac (SFL). Both structures will be located south of the proposed substation, allowing for the lines to enter directly along the south fence. The total number of structure types for this project is one (1).

All new structures on this project shall have concrete caisson foundations installed. One (1) geotechnical boring will be taken along the project to evaluate soil conditions.

4.3.4 Major Materials

Conductor, Shield Wire(s) and OPGW:

- Conductor - 2156 kcmil 84/19 Strands BLUEBIRD ACSR
- Shield Wire - 7/16” EHS

Insulators:

- 345kV Glass Bells – Double String

Structures:

- 345kV Steel Dead-End Single-Circuit Structures

Switches: N/A

4.3.5 Other Transmission Line Scope

Right-of-Way:
The proposed cut-in to the new J1629 switching station is assumed to fall within existing ATC ROW and/or proposed Ursa Solar property. It is assumed no new easement will be acquired.

Survey:

A LiDAR Survey was performed on this line in 2014 and will be used to create the model for the proposed work associated with this project. Supplemental survey will be collected as required.

Construction staking will be required for two (2) team constructability reviews, utility locates for soil boring activity, real estate review and negotiation, right-of-way clearing, and construction.

Removal of Existing Transmission Line Facilities:
The following equipment will be removed as part of this project:

- (1) 345kV Single-Circuit Steel Pole (Delta)
- 1,000 feet of 2156 ACSR Bluebird Conductor
- 300 feet of 3/8”HS Shield wire

5. List of Exhibits

The following exhibits are part of this report and attached at the end of document.

A1 Interconnection Customer One-Line & Site-Map

A2 Transmission Owner One-Lines

A3 Transmission Owner General Arrangements

A4 Transmission Line Aerial Project Overview

A5 Facilities to Be Constructed By Transmission Owner

A6 Detailed Cost of Facilities to Be Constructed By Transmission Owner

A7 Facilities to Be Constructed By Interconnection Customer

A8 Detailed Cost of Facilities to Be Constructed By Interconnection Customer

A9 Facilities Subject to Transmission Owner Reimbursement

A10 Contingent Facilities

A11 Interconnection Customer Milestones and Payment Schedule

A12 Construction and Coordination Schedules

A13 Permits, Licenses, Regulatory Approvals and Authorization

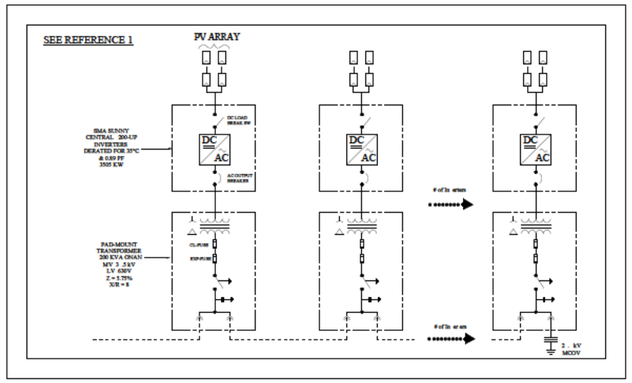
Exhibit A1: Interconnection Customer One-Line & Site Map

A1-1 Interconnection Customer One-Line

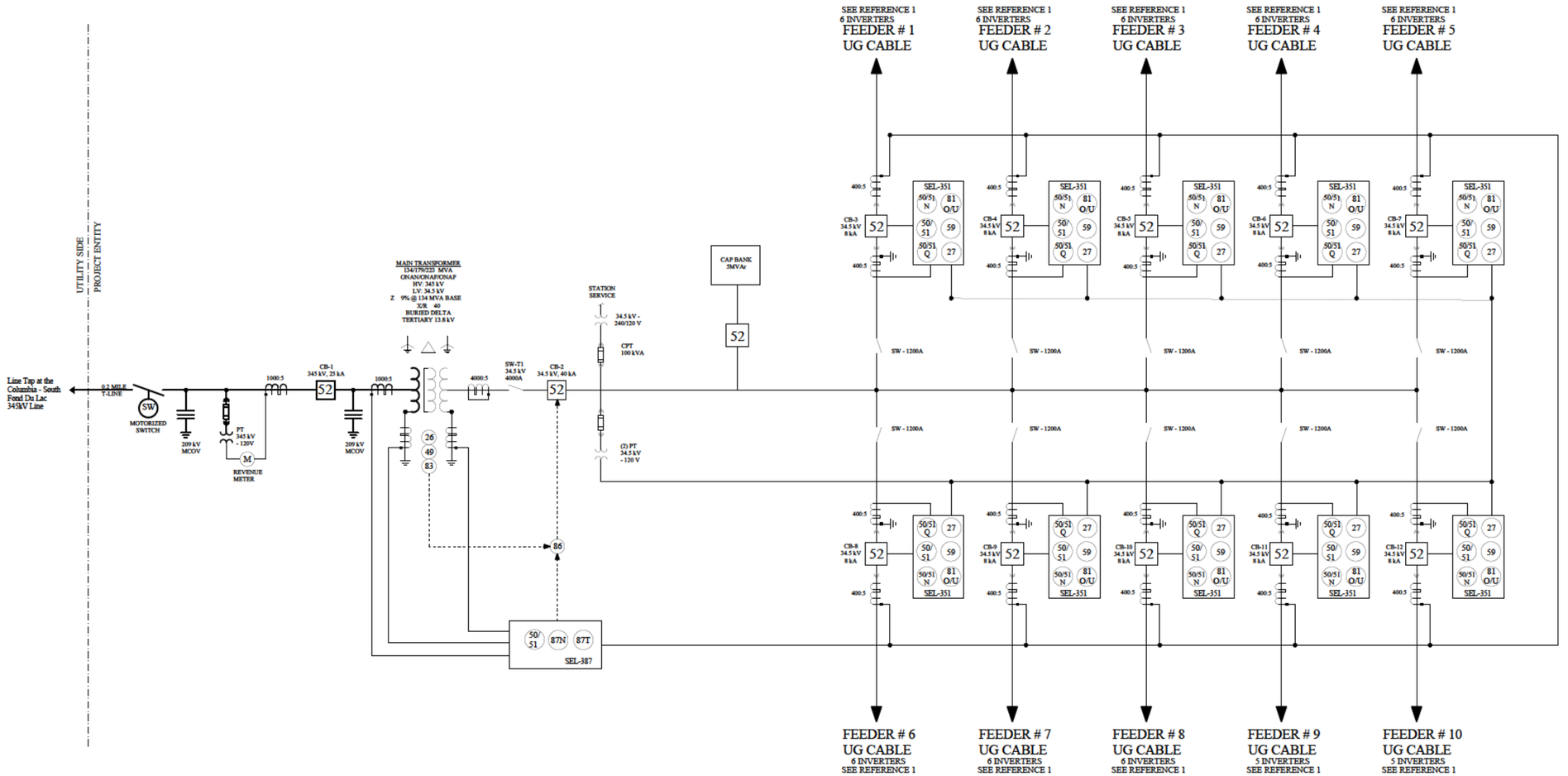
A1-2 Interconnection Customer Site Map

A1-3 Interconnection Customer Collector Substation & Switching Station Site Map

Exhibit A1-1 - Interconnection Customer One-Line



LEGEND			
	3P VISIBLE DISCONNECT		SURGE ARRESTOR
	VACUUM CIRCUIT BREAKER, DRAWOUT	DC / AC	INVERTER
	MV FUSE		PHOTOVOLTAIC MODULES
	CURRENT TRANSFORMER	86	RELAY (ANSI FUNCTION NUMBER)
	POTENTIAL TRANSFORMER		34.5 kV CABLE
	MOTORIZED SWITCH		138 kV CABLE



SAMSUNG

SAMSUNG RENEWABLE ENERGY INC.

2050 DERRY ROAD WEST 2ND FLOOR, MISSISSAUGA, ON, L5N 0B9

FOR INTERCONNECTION APPLICATION ONLY. **NOT FOR CONSTRUCTION**

STAMP

REVISION/NOTES

PROJECT:
URSA SOLAR

TITLE:
200 MW SOLAR ONE L NE DIAGRAM

ENTITY:
URSA SOLAR, LLC

DRAWING NUMBER:
SLD-001

SHEET:
1

DATE:
JUNE 19, 2020

Exhibit A1-2 - Interconnection Customer Site Map

Ursa Solar Project – Site Map

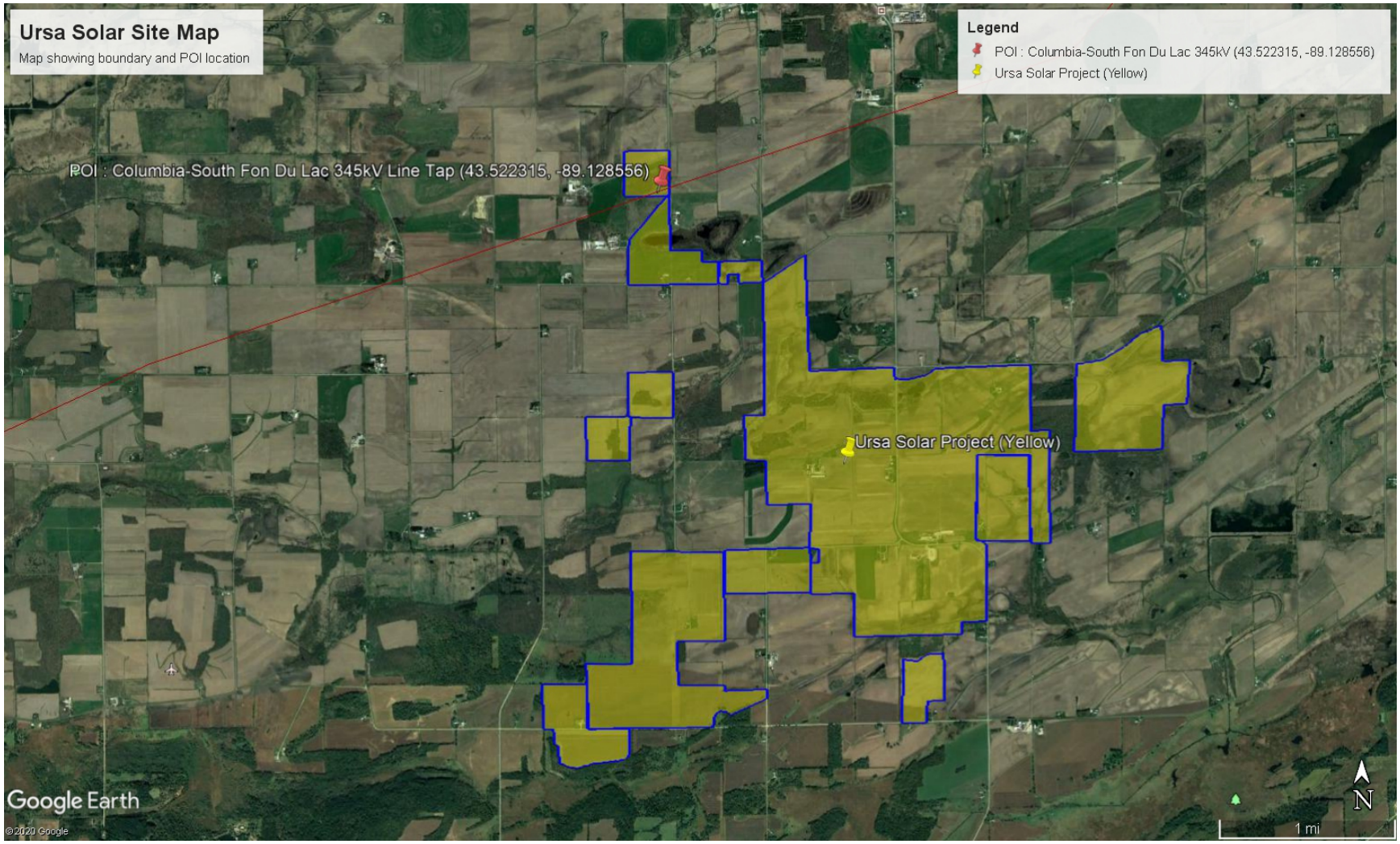


Exhibit A1-3 - Interconnection Customer Collector Substation & Switching Station Site Map

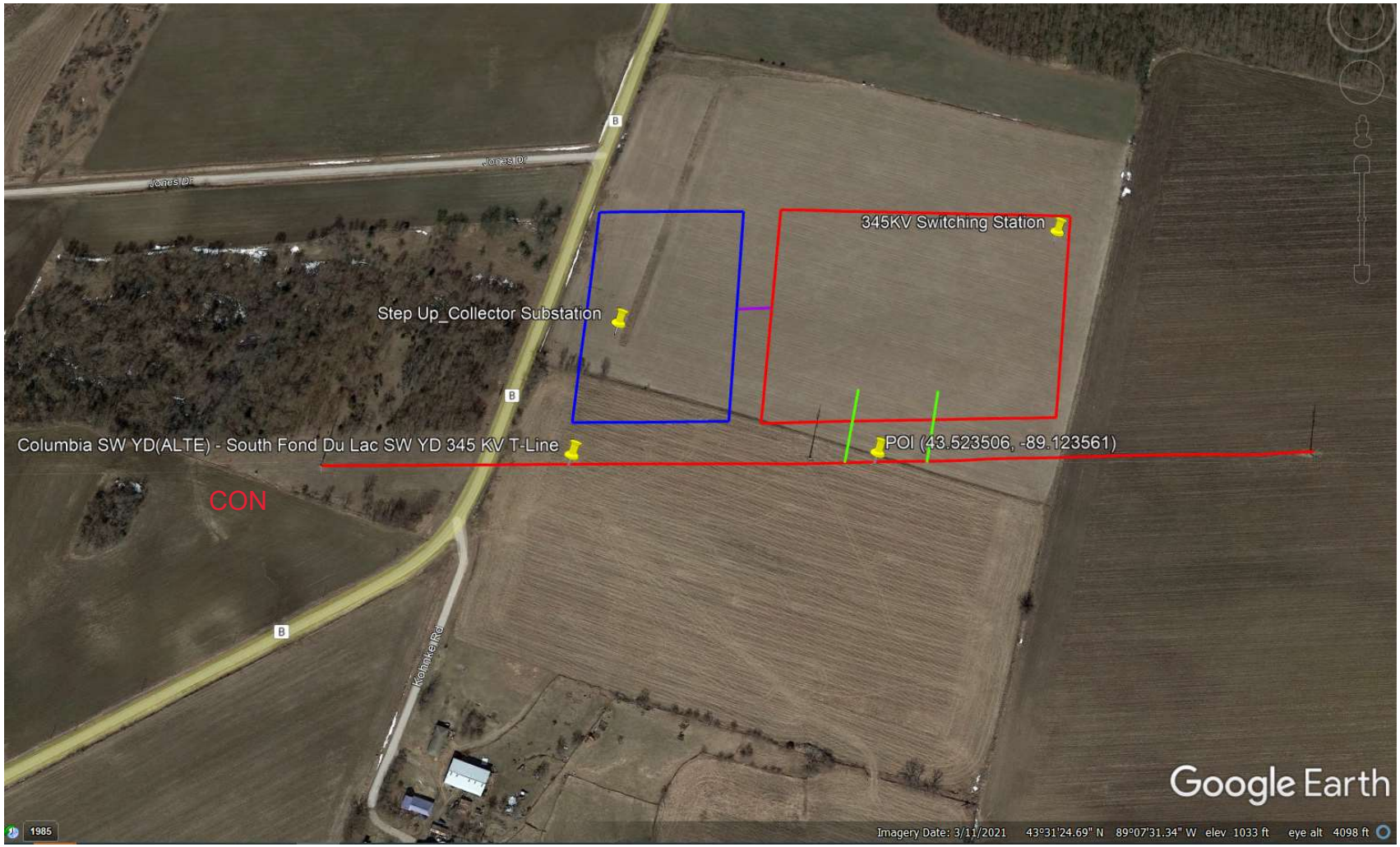


Exhibit A2: Transmission Owner One-Lines

A2-1 J1629 Switching Station Relaying One-Line Diagram

A2-2 Columbia Substation Relaying One-Line Diagram

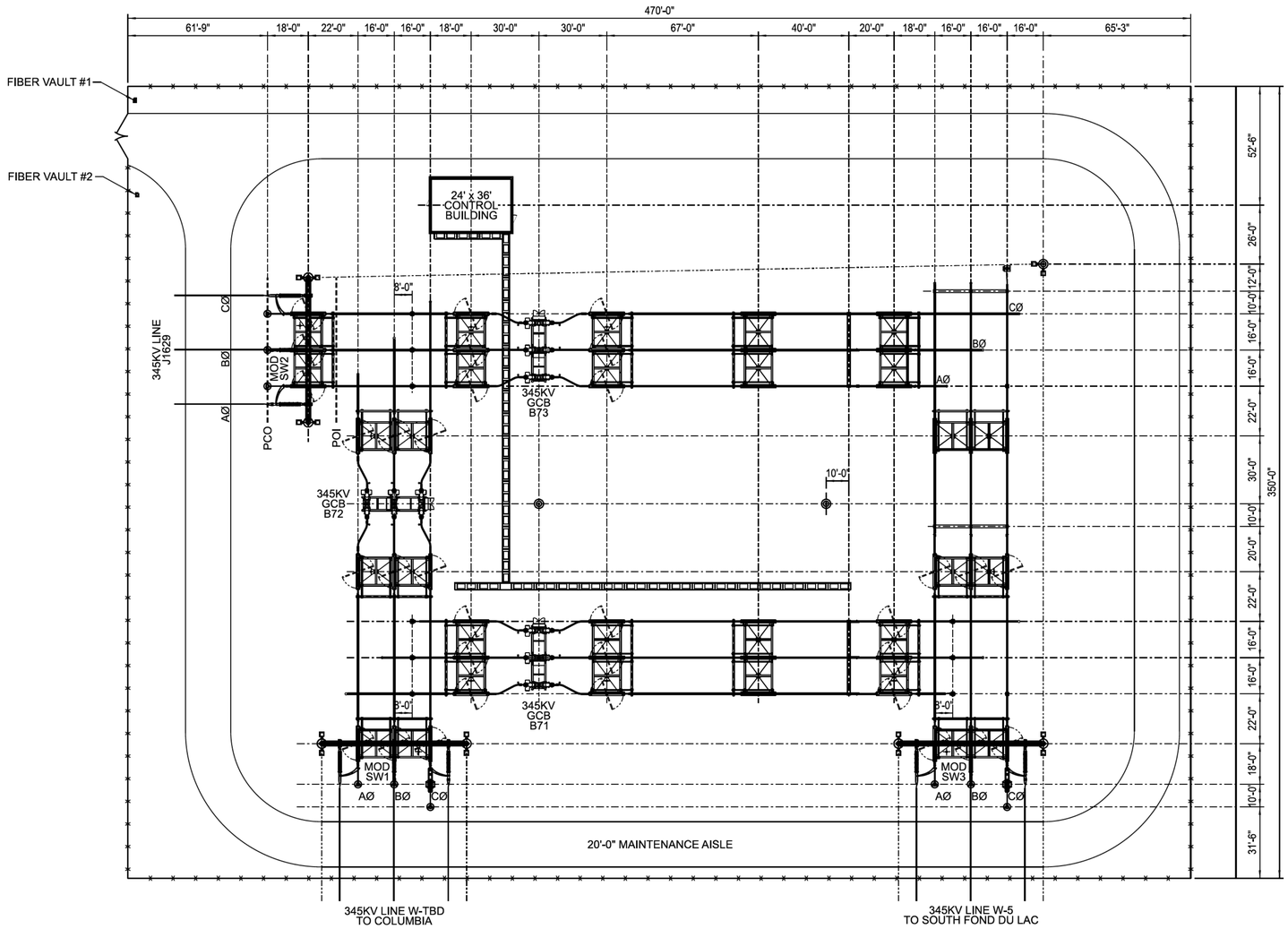
A2-3 South Fond Du Lac Substation Relaying One-Line Diagram

Exhibit A3: Transmission Owner Station Key Plans

A3-1 J1629 Switching Station Equipment Arrangement Plan

A3-2 J1629 Switching Station Control House Layout

Exhibit A3-1 - J1629 Substation Equipment Arrangement Plan



0 15' 30' 45' 60' 75'

GRAPHIC SCALE IN FEET

REV	DATE	W.O. #	DESCRIPTION	DRAWN	CHK'D	APP'D	CMPY

AMERICAN TRANSMISSION COMPANY®

345KV ELECTRICAL EQUIPMENT
PROPOSED PLAN
J1629 SUBSTATION

SCALE 1" = 30'-0"

DRAWING No. J1629 - 06 -SK4

$layout$

Exhibit A4: Transmission Line Plan and Profile Drawings

A4-1 TL-W5 345kV Transmission Line Aerial Project Overview

A4-2 Underground Fiber (69kV Y-64 Line to J1629 Switching Station)

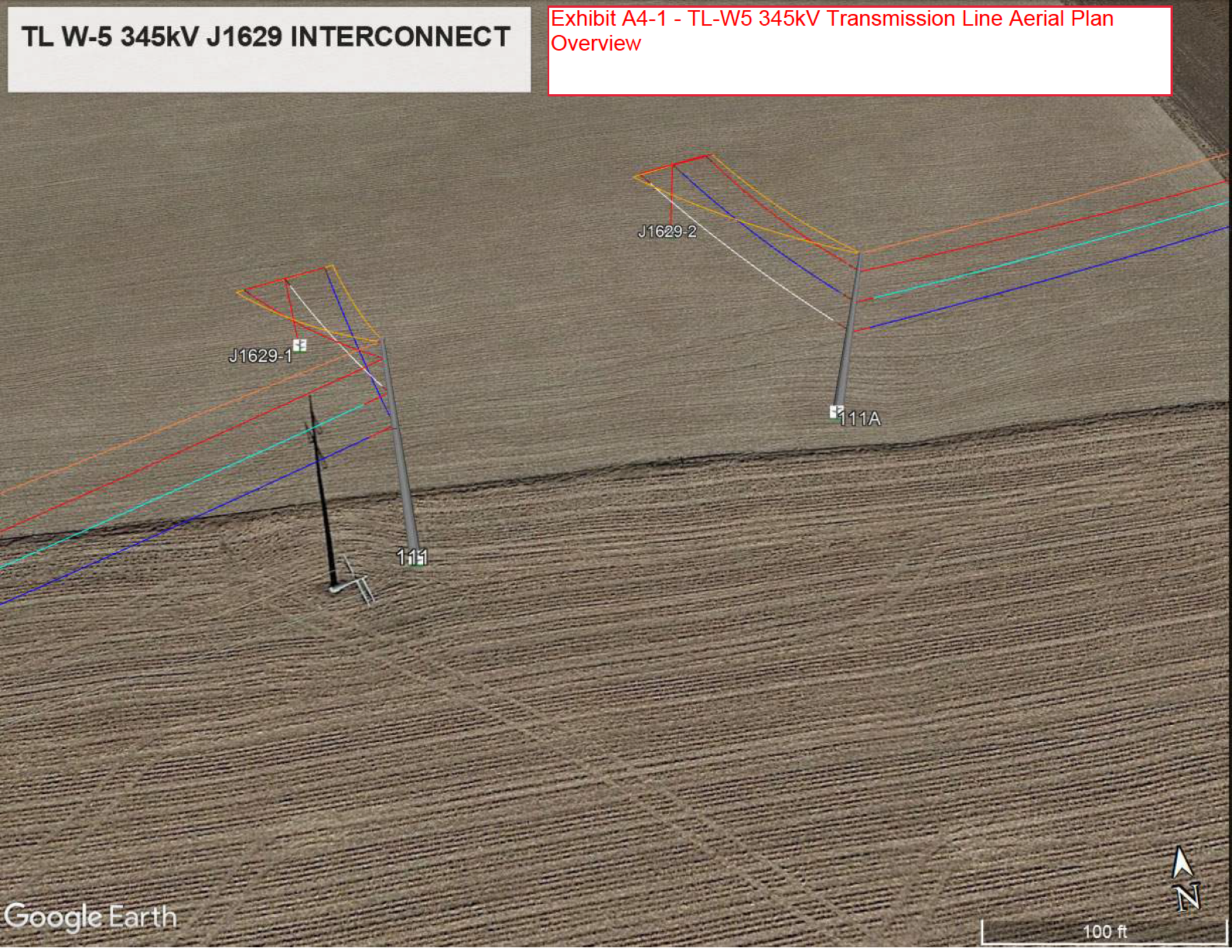

TL W-5 345kV J1629 INTERCONNECT
Exhibit A4-1 - TL-W5 345kV Transmission Line Aerial Plan Overview
J1629-2
J1629-1
111A
111
Google Earth
N
100 ft

Exhibit A4-2 - Underground Fiber (138kV Y-64 Line to J1629 Switching Station)

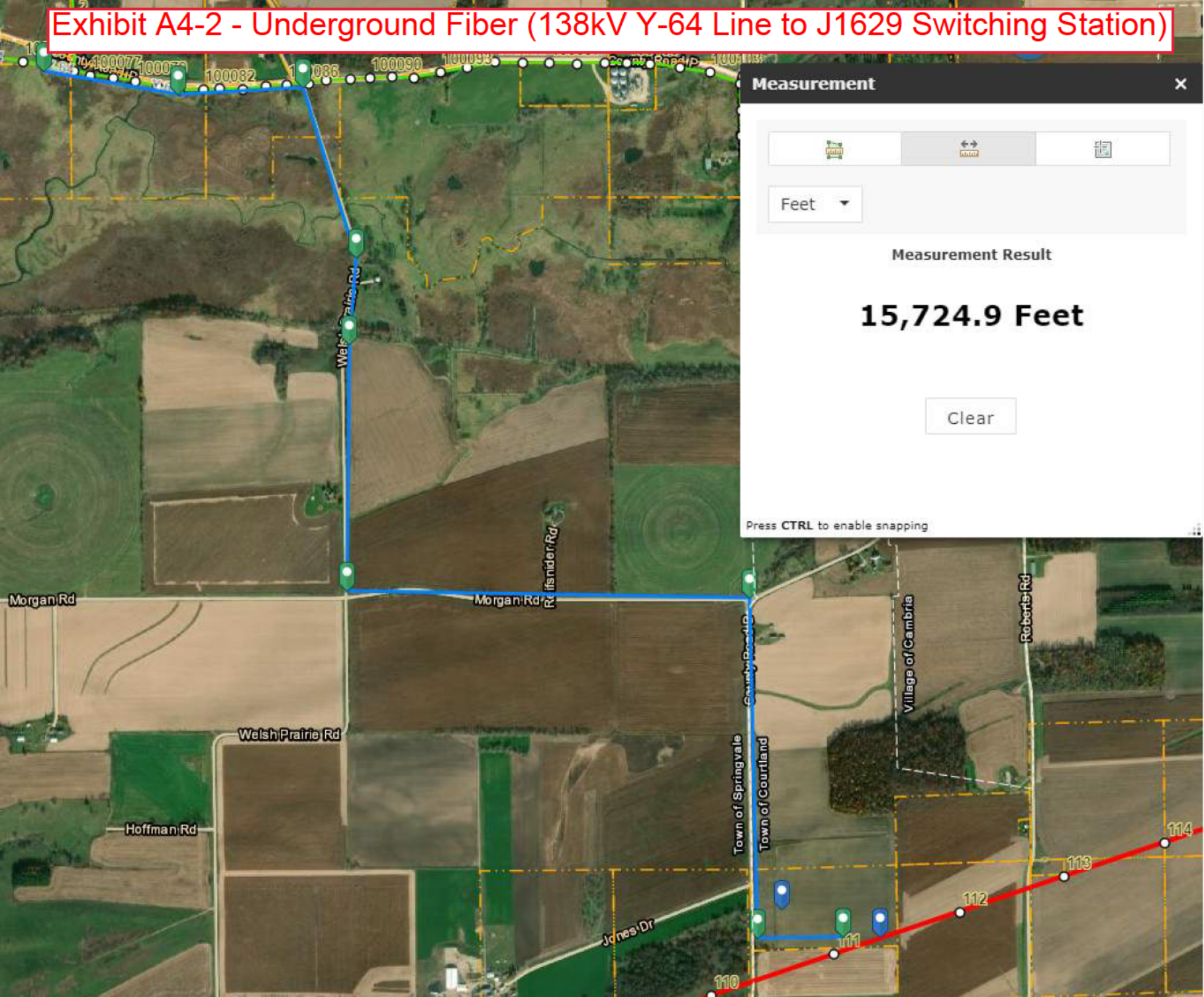


Exhibit A5: Facilities to be Constructed by Transmission Owner

Item	Location	Facilities to be Constructed by Transmission Owner	Estimate in 2025 Dollars
1	**Stand-Alone Network Upgrade**	J1629 345 kV Interconnection Switching Station	**$12,821,863**
2	**Stand-Alone Network Upgrade**	Underground Fiber	**$631,919**
3	**Non-Stand-Alone Network Upgrade**	W-5 345 kV Transmission Line Modifications	**$1,612,940**
4	**Transmission Owner Interconnection Facilities**	J1629 345 kV Interconnection Switching Station Interconnection Facilities	**$785,495**
		Total:	**$15,852,217**

Exhibit A6: Detailed Cost of Facilities to Be Constructed by Transmission Owner

Exhibit A6-1

J1629 345kV Interconnection Switching Station Cost Estimate

ITEM	DESCRIPTION	DOLLARS
1	SITE ACQUISITION AND EASEMENTS	$0
2	CONSTRUCTION, EQUIPMENT, MATERIAL	$7,614,906
3	OWNER / AGENT OVERSIGHT	$2,127,140
4	ATC PRE-CERTIFICATION PROCESS	$600,000
5	CONTINGENCY, ESCALATION, TAXES	$2,479,817
	TOTAL	$12,821,863

Exhibit A6-2

Underground Fiber Cost Estimate

ITEM	DESCRIPTION	DOLLARS
1	SITE ACQUISITION AND EASEMENTS	$0
2	CONSTRUCTION, EQUIPMENT, MATERIAL	$454,762
3	OWNER / AGENT OVERSIGHT	$62,922
4	ATC PRE-CERTIFICATION PROCESS	$0
5	CONTINGENCY, ESCALATION, TAXES	$114,235
	TOTAL	$631,919

Exhibit A6-3

W-5 345 kV Transmission Line Modifications Cost Estimate

ITEM	DESCRIPTION	DOLLARS
1	SITE ACQUISITION AND EASEMENTS	$3,000
2	CONSTRUCTION, EQUIPMENT, MATERIAL	$842,062
3	OWNER / AGENT OVERSIGHT	$495,156
4	ATC PRE-CERTIFICATION PROCESS	$0
5	CONTINGENCY, ESCALATION, TAXES	$272,722
	TOTAL	$1,612,940*

* Transmission Owner shall also collect from Interconnection Customer a tax gross-up amount on the payments made to Transmission Owner using the Transmission Owner rate in effect at the time the payment is received from Interconnection Customer.

Exhibit A6-4

J1629 345 kV Interconnection Switching Station Interconnection Facilities Cost Estimate

ITEM	DESCRIPTION	DOLLARS
1	SITE ACQUISITION AND EASEMENTS	$0
2	CONSTRUCTION, EQUIPMENT, MATERIAL	$460,459
3	OWNER / AGENT OVERSIGHT	$199,363
4	ATC PRE-CERTIFICATION PROCESS	$0
5	CONTINGENCY, ESCALATION, TAXES	$149,673
	TOTAL	$785,495*

* Transmission Owner shall also collect from Interconnection Customer a tax gross-up amount on the payments made to Transmission Owner using the Transmission Owner rate in effect at the time the payment is received from Interconnection Customer.

Exhibit A7: Facilities to Be Constructed by Interconnection Customer

There are no Network Upgrades or Interconnection Facilities currently proposed to be constructed by the Interconnection Customer within the Transmission Owner's fence.

Exhibit A8: Detailed Cost of Facilities to Be Constructed By Interconnection Customer

There are no Network Upgrades or Interconnection Facilities currently proposed to be constructed by the Interconnection Customer within the Transmission Owner's fence therefore no estimates are required.

Exhibit A9: Facilities Subject To Transmission Owner Reimbursement Pursuant To Attachment FF Of The Midcontinent ISO Tariff

Item	Location	Facilities to be Constructed by Transmission Owner	Estimate in 2025 Dollars
1	**Stand-Alone Network Upgrade**	J1629 345 kV Interconnection Switching Station	**$12,821,863**
2	**Non-Stand-Alone Network Upgrade**	W-5 345 kV Transmission Line Modifications	**$1,612,940**
		Total 345kV:	**$14,434,803**
		Total 10% Reimbursement:	**$1,443,480**

Exhibit A10: Contingent Facilities

Contingent Facilities will be determined by MISO

Exhibit A11: Interconnection Customer Milestones and Payment Schedule

Reserved (Exhibit not used by ATC)

Exhibit A12: Construction & Coordination Schedules

A preliminary proposed project milestone schedule is included below:

Project Milestone Schedule for Exhibit A5 Facilities items:

Milestone Description	Completion Date
GIA Signed & Executed	01/17/2023*
TO Receive RFS	1/27/2023
Receive IC Deposit or Security	3/13/2023
Commence Regulatory Process	5/25/2023
Regulatory Process Complete	5/24/2024
Commence Engineering Design	6/3/2024
Commence Equipment & Material Procurement	6/20/2024
TO Comment on IC's Final Design of Interconnect Facilities	11/22/2024
Commence Construction Activities	6/2/2025
Construction and Testing Complete (TO In-Service Date)	3/20/2026

Notes:

The estimated in-service date may or may not align with the Interconnection Customer's Synchronization Date; however, negotiated and executed agreements, such as an Engineering and Procurement Agreement, can be used prior to the GIA execution date to expedite Network Upgrades.

Completion of the project will be contingent on the ability to take the necessary outages to complete construction activities identified above. Actual outage requirements (dates and durations) and the ability to take the necessary outages are not known at this time and would be determined during implementation of the project.

*Based on MISO DPP-2020-Cycle 1 Schedule, Dated February 1, 2022.

Exhibit A13: Permits, Licenses, Regulatory Approvals and Authorization

Transmission Owner (TO) known regulatory approvals and authorizations for this J1629 Generation Interconnection Facilities, Facilities Study (IFFS) are as follows:

Item	Description	Required for this Project (Yes or No)
1	PSC Certificate of Authority (CA)	Yes
2	PSC Certificate of Public Convenience and Necessity (CPCN)	No
3	PSC Affiliated Interest Approval	No

All other TO permits, licenses, and regulatory approvals and authorizations for this IFFS will be confirmed during detail engineering design, such as: Building Permit, Roadway Access, Wetland Permits, Storm Water Runoff Permit, Waterway Permits, DOT Work Within Right-Of-Way Permit, County Zoning Permit, FAA Non-obstructive Permit, National Forest Service Application, etc.

Interconnection Customer (IC) permits, licenses, and regulatory approvals and authorizations for this J1629 Generation Interconnection Facilities, Facilities Study (IFFS) is explained in the ATC Generating Facility Interconnection Guide, Sections 3.3.1 and 3.3.2, as follows:

"The Customer will be responsible for obtaining all necessary zoning, building, and environmental, permits or approvals required for ATC's interconnection substation. This includes permits for impacts to waterways, wetlands, floodplains, or endangered resources and any compensatory mitigation associated with such permits. The specific permits required will depend on the characteristics of the site and the local jurisdiction. Copies of all environmental permits obtained shall be provided to ATC in order to ensure that ATC's construction of the substation meets all permit requirements.

The Customer is responsible to design, obtain permits and install all storm water management facilities for ATC's interconnection substation and the overall Customer property. The Customer will be responsible for establishing final grade, revegetation, and any necessary landscaping of the portion of their property outside of the footprint of ATC's interconnection substation. The Customer's storm water management permit shall allow for ATC's construction activities to build the substation and bring it to final grade. Long-term maintenance and inspections of all storm water management facilities are the responsibility of the Customer. If ATC's construction activities disturb areas where the Customer has completed final grading and re-vegetation, ATC will repair the disturbance in a timely manner. ATC will obtain all applicable environmental permits or approvals required for its facilities at remote end substations and transmission line assets."

If the Customer selects a POI at an existing substation that results in an expansion or need for environmental permits/approvals, ATC and the Customer (and landowner if other than ATC or Customer) will coordinate to determine which entities will be responsible for obtaining the necessary permits/approvals. This may include ATC and the Customer being co-permittees to ensure that the entity driving the need and selecting the location are represented in permit applications and supporting alternatives analysis."